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A specialized pollen-harvesting device in European bees of the genus *Tetraloniella* (Hymenoptera, Apidae, Eucerini)

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A b s t r a c t : The females of six closely related European *Tetraloniella* species are equipped with a specialized pilosity on the abdominal sternites 3-5 composed of numerous hairs robust at their base and wavyly twisted in their apical portion. This sternal pilosity is used to efficiently remove pollen from the flower heads of *Inula* and *Pulicaria* (Asteraceae), respectively.

K e y w o r d s : Apiformes, Asteraceae, *Inula*, pollen collection, *Pulicaria*.

Flowers of the Asteraceae are the exclusive pollen source of many oligolectic bee species (WESTRICH 1989, MÜLLER & BANSAC 2004). The great majority of bees specializing on Asteraceae use the basitarsal brushes of the forelegs or the abdominal scopa for removing pollen from the composite flower heads (GRINFEL'D 1962, MICHENER et al. 1978, WESTERKAMP 1987, WESTRICH 1989, MÜLLER 1996). However, basitarsal brushes serve primarily as a grooming device (GRINFEL'D 1962, JANDER 1976), and abdominal scopae are above all pollen transport structures (WESTERKAMP 1987, WESTRICH 1989). Morphological specializations, which primarily evolved for pollen collection on Asteraceae, are only exceptionally observed in bees. In three *Anthidium* species, a specialized pilosity covering the underside of the thorax is used to wipe pollen from inflorescences of the Asteroideae (MÜLLER 1996). In eight *Megachile* species belonging to two different lineages, a conspicuous brush of stiff bristles on the ventral side of trochanter and femur of each hind leg serves to comb pollen from the flower heads of knapweeds and thistles (MÜLLER & BANSAC 2004). Similar hind leg brushes occur in several palaearctic *Osmia* species of the subgenus *Helicosmia* (Megachilidae), where they most probably serve to harvest pollen from knapweeds and thistles as well (A. Müller, personal observation). Here, we describe a hitherto unknown pollen-harvesting device in a clade of eucerine bees, which is used to exploit the inflorescences of two closely related genera within the Asteroideae.

The group of *Tetraloniella ruficornis* (Apidae, Eucerini) consists of six closely related species in Europe (TKALCŮ 1979), which show a probably exclusive preference for the flowers of *Inula* and *Pulicaria* as pollen hosts: *T. alticincta* is known to collect pollen on *Inula ensifolia*, *I. germanica* and *Pulicaria dysenterica* (TKALCŮ 1979, WESTRICH 1989), *T. fulvescens* visits *I. candida*, *I. ensifolia*, *I. hirta*, *I. germanica*, *I. montana* and *I. salicina* (TKALCŮ 1979, MAZZUCCO & MAZZUCCO 2007, A. Müller personal observation), and *T. inulae* was observed on *I. ensifolia*, *I. germanica*, *I. oculus-christi* and *I.*

spiraeifolia (TKALCŮ 1979, A. Müller personal observation). For the remaining three species, no flower records are available. The inflorescences of *Inula* and *Pulicaria* are composed of numerous flowers, which are densely packed in a single plane all offering pollen at the same height (Fig. 1).

In the females of all six European species of the *Tetraloniella ruficornis* group, the sternites 3-5 are densely covered with numerous hairs robust at their base and wavily twisted in their apical portion (Fig. 2). This specialized pilosity, which is lacking in the male sex, is regularly found to be densely filled with pollen grains in pinned female specimens indicating that it is a morphological adaptation for pollen collection.

The field observation of several females of *Tetraloniella alticincta* (LEPELETIER 1841) in the Abruzzo mountains in central Italy in August 2007 revealed that the specialized sternal pilosity is indeed used to remove pollen from the flower heads of *Pulicaria dysenterica* (L.) BERNH. (Fig. 1). All females were observed to collect pollen in exactly the same manner: after landing on the inflorescence, the bees walked slowly across the flower head continuously moving the abdomen rapidly but inconspicuously back and forth, thereby brushing the pollen grains into the specialized sternal pilosity. Careful observation with the aid of a threefold magnifying lens showed that the abdominal movements were generated by the rapid extension and contraction of the abdominal segments. During the process of pollen collection, the females constantly inserted their proboscis into new flowers for nectar uptake. In short intervals, the bees lifted the abdomen slightly and moved their hind legs underneath, probably to remove pollen adhering to the sternal pilosity with the help of the basitarsal brushes. The transfer of the pollen grains from the basitarsi into the tibial scopa could not be observed. This transfer possibly takes place in flight after the bees leave the flower heads.

In conclusion, the specialized sternal pilosity in the females of the *Tetraloniella ruficornis* group is clearly a morphological adaptation evolved to efficiently harvest pollen from small flowers packed in dense inflorescences.

Zusammenfassung

Die Weibchen sechs nah verwandter Bienenarten der Gattung *Tetraloniella* (Apidae, Eucerini) sind mit einer spezialisierten Behaarung auf den Abdominalsterniten 3-5 ausgestattet. Diese Behaarung, die sich aus zahlreichen und an ihrer Spitze wellenförmig verbogenen Borsten zusammensetzt, dient dazu, Pollen von den Blütenköpfen der beiden nah verwandten Pflanzengattungen *Inula* und *Pulicaria* (Asteraceae) abzustreifen.

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Fig. 1: Female of *Tetrioniella alticincta* on *Pulicaria dysenterica*. Foto: Hugues MOURET.

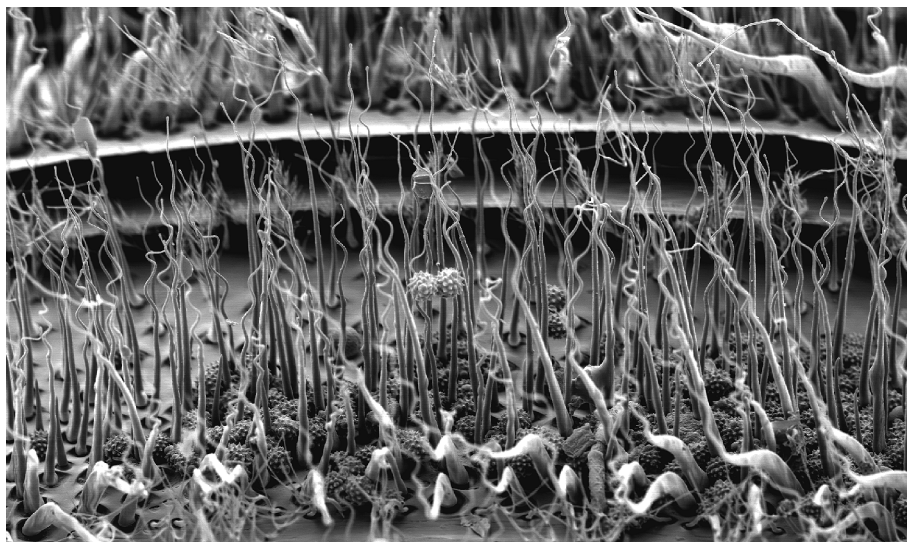


Fig. 2: Specialized pilosity on abdominal sternite 3 of *Tetrioniella alticincta* with pollen grains of Asteroideae. Foto: Christof EICHENBERGER.